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Digital Exposure, Sleep Deficit, and Psychological Distress in U.S. Adolescents

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Abstract

Research on adolescent screen use, sleep, and distress is difficult to integrate because national surveys cover different populations and have changed their screen-time measures. This study applied a surveillance-triangulation framework to official U.S. Youth Risk Behavior Survey (YRBS) estimates from 2013–2023 and National Health Interview Survey–Teen (NHIS–Teen) estimates from July 2021–December 2023. Published weighted prevalences were compared descriptively using percentage-point changes, demographic gaps, and unadjusted prevalence ratios while keeping the surveys separate. YRBS non-school digital use of at least three hours rose from 41.3% in 2013 to 46.1% in 2019, before a major change in screen-time measurement. Only 23% of high-school students reported at least eight hours of school-night sleep in 2023. In NHIS–Teen, anxiety symptoms were 27.1% versus 12.3% (prevalence ratio 2.20), and depression symptoms were 25.9% versus 9.5% (ratio 2.73), for adolescents with at least four versus fewer than four daily screen hours. These unadjusted, cross-sectional and aggregate findings do not establish individual co-occurrence or causality. By distinguishing measurement discontinuities, population sleep shortfalls, and symptom gradients, the framework supports clearer public-health monitoring and more targeted assessment of adolescent sleep and psychological well-being.

Keywords: adolescents, screen time, sleep, psychological distress, surveillance.

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INTRODUCTION

Adolescent digital exposure has become a population-health issue because screens now mediate schooling, entertainment, social relationships, identity work, and access to information. The epidemiological problem is not simply that adolescents use screens, but that high-frequency leisure use can accumulate during time that is also needed for sleep, physical activity, and emotional recovery. Reviews consistently show substantial heterogeneity by device, platform, purpose, and timing, which makes an undifferentiated daily total an imperfect exposure measure (Qi et al., 2023; Ricoy et al., 2022; Stiglic & Viner, 2019). This heterogeneity is especially relevant for public-health surveillance: a measure that once emphasized computers and video games must now capture smartphones, streaming, social media, messaging, and multi-device use. Population trends therefore need to be interpreted together with changes in the wording and scope of surveillance instruments rather than treated as a perfectly continuous time series.

Sleep is an especially important outcome because adolescence combines a developmental tendency toward later circadian timing with fixed early school schedules. Sleep recommendations generally place adolescents in an eight-to-ten-hour range, yet many high-school students report less than eight hours on school nights (Paruthi et al., 2016; Ramar et al., 2021). Experimental and developmental evidence indicates that inadequate or irregular sleep can compromise attention, executive control, affect regulation, learning, and broader brain development (Tarokh et al., 2016; Dutil et al., 2018). Digital activity can intersect with these vulnerabilities through time displacement, nocturnal notifications, social or gaming arousal, and light exposure, although the magnitude of each pathway depends on context (Tähkämö et al., 2019; Hartstein et al., 2024). Sleep is therefore useful not only as an outcome but also as a population-level vulnerability that may help explain why the same amount of screen exposure is not equally consequential for all adolescents.

Mental-health outcomes add a second layer of complexity. Systematic reviews have reported associations between screen exposure and depressive symptoms, anxiety, psychological distress, and lower well-being, but they also emphasize confounding, reverse causation, and inconsistent exposure definitions (Santos et al., 2023; Yang et al., 2022). Problematic internet use and gaming appear more consistently associated with sleep problems and distress than ordinary use, suggesting that behavioral dysregulation is important (Kokka et al., 2021; Wang et al., 2021). Prospective evidence similarly supports bidirectionality: digital activity may extend or fragment wakefulness, while adolescents already experiencing poor sleep, loneliness, anxiety, or low mood may increase digital engagement for distraction or reassurance (Dibben et al., 2023; Bauducco et al., 2024). Recent within-person synthesis also cautions against assuming that every day with more screen time necessarily produces large changes in every sleep dimension, reinforcing the need to distinguish population gradients from individual causal effects (Bourke et al., 2026).

Most research on adolescent screens, sleep, and distress synthesizes associations from studies using different exposure definitions, samples, and analytic designs (Snyder, 2019; Santos et al., 2023; Yang et al., 2022). A distinct surveillance gap remains: few integrated accounts show which national indicators can be compared across years, which cannot, and what conclusions remain defensible when exposure, sleep, and symptoms come from different survey populations. Conventional evidence reviews can assess proposed mechanisms, but they cannot resolve changes in the wording of successive national surveillance questions. The present analysis addresses this gap by separating directly reported weighted prevalences from author-calculated contrasts and from mechanisms inferred only from prior research.

Two official surveillance systems contribute complementary, not interchangeable, evidence. The Youth Risk Behavior Survey (YRBS) repeatedly measures indicators among students in grades 9–12, enabling historical descriptions of school-night sleep, mental health, and earlier non-school device use. The household-based National Health Interview Survey–Teen (NHIS–Teen) covers ages 12–17 and provides recent non-school weekday screen-time categories with screen-stratified anxiety and depression symptoms. Their differing age ranges, sampling frames, and screen questions preclude pooling estimates or assuming that subgroup contrasts describe the same adolescents. Triangulation here means comparing the direction, distribution, and limits of separate national signals, not linking individual exposure, sleep, and distress records.

This study has three objectives: to describe historical and contemporary digital-exposure estimates while documenting questionnaire discontinuities; to quantify school-night sufficient-sleep trends and demographic gaps; and to describe screen-stratified anxiety and depression symptoms alongside separate YRBS mental-health indicators. Its methodological contribution is an explicitly segmented surveillance-triangulation framework that records where trends are approximately comparable and where different survey constructs prevent direct comparison. Published weighted proportions are retained within their original populations, and derived percentage-point differences and prevalence ratios are identified as descriptive rather than adjusted estimates. The framework makes previously separate official indicators interpretable together for surveillance planning without claiming that screen exposure, insufficient sleep, and psychological distress co-occur within particular individuals or form a causal chain.

RESEARCH METHODS

A retrospective secondary analysis used publicly available, nationally weighted U.S. adolescent surveillance estimates. Sources were selected when they documented a national adolescent population, survey period, indicator wording or response categories, and published prevalence relevant to digital use, sufficient sleep, or psychological symptoms. Eligible sources were CDC national YRBS reports for 2013, 2015, 2017, and 2019 screen exposure (CDC, 2014, 2016, 2018; Merlo et al., 2020); 2021 and 2023 YRBS item guides and national trends reports (CDC, 2023, 2024a, 2024b, 2025); and NCHS Data Brief No. 513, based on NHIS–Teen interviews from July 2021 through December 2023 (Zablotsky et al., 2024). Estimates from nonnational samples and peer-reviewed reviews were not treated as observations. The documented extraction date was 16 September 2026. For each reported value, the analysis retained its survey, year, target population, threshold or response category, and published prevalence; Tables 1–6 identify the relevant comparisons and sources. Scientific articles were used only to interpret possible mechanisms, not to supply surveillance numerators or denominators.

YRBS is a biennial school survey of U.S. students in grades 9–12 using three-stage cluster sampling and weights for its national target population. In 2023 it included 20,103 respondents, with school, student, and overall response rates of 49.8%, 71.0%, and 35.4%, respectively. Although CDC applied weighting and examined nonresponse bias, the low overall rate leaves potential selection bias that these procedures cannot exclude. NHIS–Teen instead samples civilian, noninstitutionalized adolescents ages 12–17 through a household frame; its weekday screen-time item excludes schoolwork, and anxiety and depression symptoms use GAD-2 and PHQ-2 screeners. School enrollment, differing age coverage, self-reported screen and sleep behavior, symptom recall, and social-desirability effects limit direct cross-survey inference. No participant records were linked, and generalizations were confined to each survey's defined population.

Instrument comparability was assessed using question scope, response categories, reference period, and target population before calculating any temporal change. During 2013–2019, YRBS captured at least three hours on an average school day spent gaming or using computers or digital devices for non-school activities; examples and device coverage evolved, so this historical segment is broadly, but not perfectly, comparable. The 2021 item covered television, smartphones, other screens, streaming, Internet use, gaming, and social media, using six time categories instead of the earlier binary threshold. Consequently, the 2021 screen-time distribution was described separately and was not subtracted from the 2019 percentage as if the measures were identical. Additional 2023 social-media measures were likewise not spliced into a continuous 2013–2023 screen-time series. NHIS–Teen weekday screen categories and YRBS school-day items were never treated as equivalent exposure definitions; the surveillance streams were compared only at the conceptual level.

Analysis used published weighted point estimates and did not reweight respondents or pool the two survey systems. Absolute change was calculated in percentage points (PP = P_later - P_earlier), relative change as [(P_later - P_earlier)/P_earlier] × 100, prevalence difference as P_high - P_low, and unadjusted prevalence ratio as P_high/P_low. Calculations used reported, sometimes rounded, percentages; small rounding discrepancies are therefore possible. Demographic contrasts were descriptive, and original confidence intervals or significance statements were retained only when the source report supplied them. No individual-level regression, multivariable adjustment, formal trend test, mediation analysis, or confidence interval for the derived prevalence ratios was performed. Without individual-level covariates, these contrasts may reflect differences in age, family resources, school conditions, baseline distress, or other confounders; aggregate data cannot establish individual co-occurrence or causation. The sources contained de-identified population estimates, so no participants were recruited or identifiable health records accessed.

Table 1. Official Surveillance Data Architecture Used in the Analysis

Source	Period / population	Indicators used	Analytical role
National YRBS surveillance reports	2013, 2015, 2017, 2019; grades 9–12	≥3 h/day non-school computer or digital-device use	Historical digital-exposure segment
2021 National YRBS Data User's Guide	2021; grades 9–12	Six-category weekday screen-time distribution	Redesigned exposure benchmark; kept separate
YRBS Data Summary & Trends Report	2013–2023; grades 9–12	Persistent sadness or hopelessness; subgroup trends	Decade mental-health trend
YRBS Sleep Trends Report	2013–2023; grades 9–12	≥8 h sleep on average school night	Sleep trend and 2023 subgroup gaps
NHIS–Teen / NCHS Data Brief No. 513	Jul 2021–Dec 2023; ages 12–17	Daily screen time; anxiety; depression	Contemporary exposure distribution and prevalence gradients

Sources: CDC YRBS reports/data guides and NCHS Data Brief No. 513.

Table 1 specifies the source, population, indicator, and analytic role for each surveillance stream. Reproducibility rests on preserving the reported definitions and showing which contrasts are author calculations rather than directly published estimates. The analysis treats survey estimates as observations at the population level and scientific reviews as contextual evidence, thereby preventing descriptive trends from being mistaken for individual-level exposure–outcome effects.

RESULTS AND DISCUSSION

Digital Exposure Changed Faster Than Its Measurement Architecture

The historical YRBS series documents an increase in the proportion of students reporting at least three hours of non-school computer, gaming, or digital-device use: 41.3% in 2013, 41.7% in 2015, 43.0% in 2017, and 46.1% in 2019. The endpoint difference is 4.8 percentage points, or 11.6% relative to 2013. These are changes in published weighted point estimates, not a formally tested trend; confidence intervals and harmonized item-level responses were not available for a new uncertainty analysis here. Changes in device examples within the historical questions also limit strict comparability, even before the more substantial 2021 redesign. The defensible result is an upward descriptive pattern within a broadly similar pre-redesign measure, not a precise estimate of a device-independent behavioral shift.

Table 2. National Indicators of Adolescent Digital Exposure

Survey / year	Official measure	Weighted prevalence
YRBS 2013	≥3 h/day non-school computer/video-game use	41.3%
YRBS 2015	≥3 h/day non-school computer/video-game use	41.7%
YRBS 2017	≥3 h/day non-school computer/digital-device use	43.0%
YRBS 2019	≥3 h/day non-school computer/digital-device use	46.1%
YRBS 2021	<1 h / 1 h / 2 h / 3 h / 4 h / ≥5 h screen time	6.1 / 4.6 / 13.5 / 19.2 / 17.5 / 39.2%
NHIS–Teen 2021–2023	<1 h / 1 h / 2 h / 3 h / ≥4 h weekday screen time	3.0 / 6.1 / 17.8 / 22.8 / 50.4%

Sources: CDC national YRBS surveillance reports and 2021 Data User's Guide; NCHS Data Brief No. 513.

Table 2 separates the 2013–2019 threshold measure from the redesigned 2021 categories and the NHIS–Teen distribution. Under the broader 2021 YRBS wording, 6.1% reported less than one hour, 4.6% one hour, 13.5% two hours, 19.2% three hours, 17.5% four hours, and 39.2% five or more hours. The displayed categories total 75.9% at three hours or more, subject to rounding. This value cannot be compared with the 46.1% recorded in 2019 as a 29.8-point increase in behavior, because the question included a wider range of devices and activities. The apparent discontinuity is therefore a feature of measurement, and its behavioral component cannot be isolated using the reported aggregates alone.

The scope of measurement determines how the digital-exposure results can be used. Reviews emphasize that similar daily screen totals may combine different device types, social activities, and levels of nighttime engagement (Qi et al., 2023; Stiglic & Viner, 2019; Ricoy et al., 2022). Greater device coverage can improve relevance to contemporary media habits, but it reduces continuity with older computer-focused questions. The implication for surveillance is to document item wording and category changes alongside every trend chart and, where feasible, maintain stable core questions while adding activity-specific modules. These recommendations arise from measurement limitations rather than from a new estimate of screen-related harm.

The contemporary NHIS–Teen distribution confirms that long leisure screen exposure is common even when measured with a different household-based survey. From July 2021 through December 2023, 50.4% of adolescents ages 12–17 reported at least four hours of daily screen time on a typical weekday excluding schoolwork; another 22.8% reported three hours. Only 9.1% reported one hour or less. The concentration in the upper categories implies that a threshold-based policy message such as 'reduce all screen time below two hours' would apply to a very large share of adolescents without distinguishing purpose, timing, or functional impairment. That is precisely why newer evidence favors mechanism-sensitive interpretation rather than treating duration as a diagnosis in itself (Brautsch et al., 2023; Fiore et al., 2025).

The NHIS–Teen estimate of at least four weekday screen hours differed by age and race or ethnicity. Prevalence was 55.0% at ages 15–17 versus 45.6% at ages 12–14; 60.4% among Black non-Hispanic, 52.8% Hispanic, 47.9% White non-Hispanic, and 43.5% Asian non-Hispanic adolescents. Corresponding estimates were 48.3% for boys and 52.5% for girls. These descriptive gaps can guide stratified surveillance and motivate attention to access, school demands, family context, and opportunities for non-screen recreation. They do not identify the reasons for group differences or show that a demographic characteristic, screen duration, or a particular device causes mental-health symptoms. No demographic-adjusted comparisons were calculated in this analysis.

Figure 1 displays only the 2013–2019 YRBS estimates under the earlier screen question. The modest endpoint increase must be interpreted alongside changes in device examples and the absence of a newly calculated standard error or formal trend test. Excluding the 2021 distribution from the same line prevents the broader item definition from appearing as a sudden increase in behavior. A practical improvement for future monitoring would be parallel administration or statistical calibration of old and new screen questions during transition years. Such calibration was not available in the published aggregates examined here.

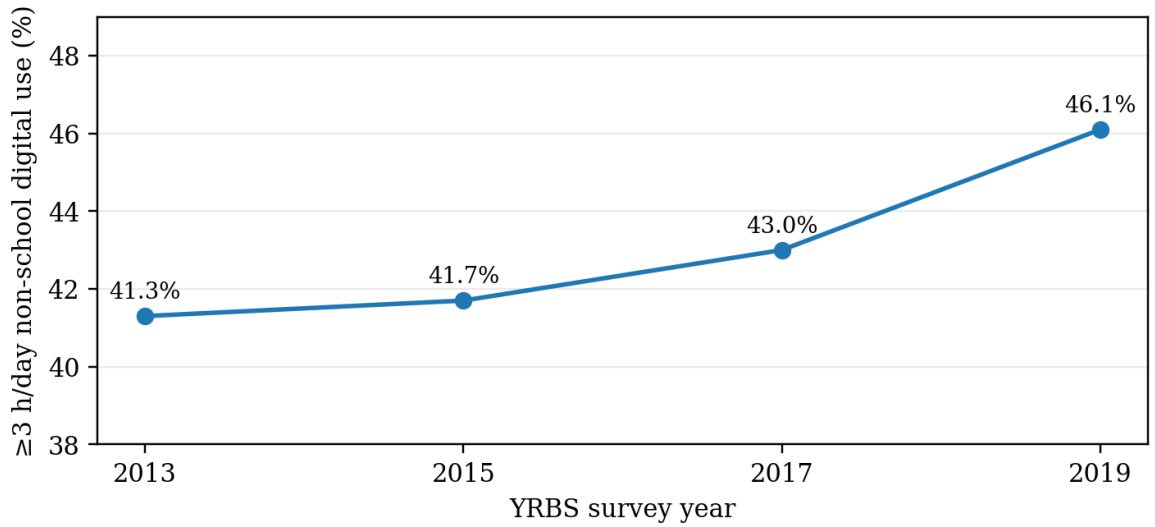


Figure 1. Historical Prevalence of ≥3 Hours/Day Non-School Digital Use, YRBS 2013–2019
Source: Author calculations from CDC national YRBS surveillance estimates. The 2013–2019 series is shown separately because the screen-time item was redesigned in 2021.

Peer-reviewed evidence helps interpret, but does not supply, the surveillance observations. Lund et al. (2021) and Han et al. (2024) describe associations between electronic-media use and sleep timing or quality, while Pagano et al. (2023) emphasizes the importance of when and how screens are used. Pillion et al. (2022) also identifies differences across devices and applications. These findings make total screen duration a plausible marker of several behaviors, not a measured mechanism in the present YRBS or NHIS–Teen analysis. Distinguishing the official descriptive results from external mechanistic studies avoids attributing pathways to variables not jointly examined in the source data.

The historical YRBS increase and high contemporary NHIS–Teen prevalence indicate that extended non-school screen use is common, although the differing questions preclude quantifying one continuous trajectory. Research on social networks and smartphones suggests that use near bedtime may matter more for sleep than equal exposure earlier in the day (Gaya et al., 2023; de Sá et al., 2023). Mei et al. (2018) also reports links between excessive technology use and sleep problems. These external findings provide hypotheses about timing and self-regulation; the surveillance estimates here do not identify which activities, devices, or hours displaced sleep. A public-health assessment should therefore ask about context rather than infer functional impairment from duration alone.

Recent within-person evidence provides an important counterweight to overinterpretation. Bourke et al. (2026) found only a small within-person association between greater daily screen use and later sleep onset, with no statistically significant association across several other sleep dimensions. Brozatus et al. (2026), by contrast, summarizes a much larger review literature that often reports adverse

associations but also identifies extensive methodological weakness and reliance on cross-sectional self-report. Together these findings support the present study's decision to treat official prevalence estimates as surveillance indicators rather than causal coefficients. The population burden can be large even when individual short-term effects are heterogeneous, and causal inference requires designs that are stronger than repeated aggregate prevalence comparisons.

The first objective yielded two distinct findings: screen exposure increased descriptively within the broadly comparable 2013–2019 YRBS series, and extended screen use was common in contemporary but differently defined surveys. No statistically tested historical trend or directly comparable cross-instrument growth rate was established. Surveillance systems could reduce this ambiguity by retaining stable core duration items and separately recording device, activity, timing, and nighttime access. Until those measures are harmonized, screen-hour estimates should describe exposure distributions rather than serve as individual causal risk scores.

Sleep deficit became a persistent population-level vulnerability

The second surveillance pattern is a persistent deficit in sufficient school-night sleep. In 2023, only 23% of U.S. high-school students reported obtaining at least eight hours of sleep on an average school night. This threshold is conservative relative to the broader adolescent recommendation of eight to ten hours, so the result does not describe an unusually stringent sleep standard (Paruthi et al., 2016). It instead indicates that roughly three quarters of students failed even to meet the lower bound. Sleep is therefore not a marginal co-outcome in the digital-health debate; it is a widespread population vulnerability that can amplify the functional consequences of stress, late-night engagement, early school schedules, and other demands. Ramar et al. (2021) frames sleep as foundational to health, while Tarokh et al. (2016) and Dutil et al. (2018) explain why adolescence is developmentally sensitive to chronic restriction.

The published YRBS endpoint estimates indicate that sufficient school-night sleep declined for girls and boys between 2013 and 2023. Among girls, prevalence fell from 29% to 22%, a 7-point or 24.1% relative decrease; among boys, it fell from 35% to 25%, a 10-point or 28.6% relative decrease. These descriptive changes document a worsening of the sleep indicator within the school-based surveillance population. They cannot be linked to the historical screen indicator at the student level, and the instruments do not support a new adjusted screen–sleep analysis. School start times, schedules, household demands, stress, and other time-varying factors offer alternative explanations that cannot be separated with these aggregates.

Table 3 shows variation in 2023 sufficient sleep across reported demographic groups. At least eight hours was reported by 22% of girls and 25% of boys, by 19% of Asian and Black students, 24% of Hispanic students, 25% of White students, and 17% of multiracial students. The CDC estimates were 16% among LGBTQ+ students and 25% among cisgender and heterosexual students, a 9-point difference and an unadjusted prevalence ratio of 0.64. These values identify unequal sleep attainment within surveyed subgroups, not innate vulnerability or the effect of digital exposure. Differences in school arrangements, socioeconomic resources, discrimination, family responsibilities, and perceived stress warrant examination in designs with relevant covariates.

Table 3. Sufficient Sleep by Demographic Group, YRBS 2023

Group	≥8 h sleep (%)	Difference from total (pp)
Total	23	0
Female	22	-1
Male	25	+2
Asian	19	-4
Black	19	-4
Hispanic	24	+1
White	25	+2
Multiracial	17	-6
Cisgender and heterosexual	25	+2
LGBTQ+	16	-7

Source: CDC Youth Risk Behavior Survey Data Summary & Trends Report for Dietary, Physical Activity, and Sleep Behaviors: 2013–2023.

Figure 2 illustrates between-group variation in sufficient sleep, not the causes of that variation. School start times, commuting, paid work, caregiving, household routines, neighborhood conditions, and psychosocial stress may all limit sleep opportunity. The estimates cannot determine which explanation dominates or whether the same students have high screen exposure. Public-health interpretation should therefore distinguish a measured sleep deficit from hypotheses about competing demands on adolescents' time. Group-specific assessment is warranted, but the descriptive data alone cannot identify an effective intervention for any subgroup.

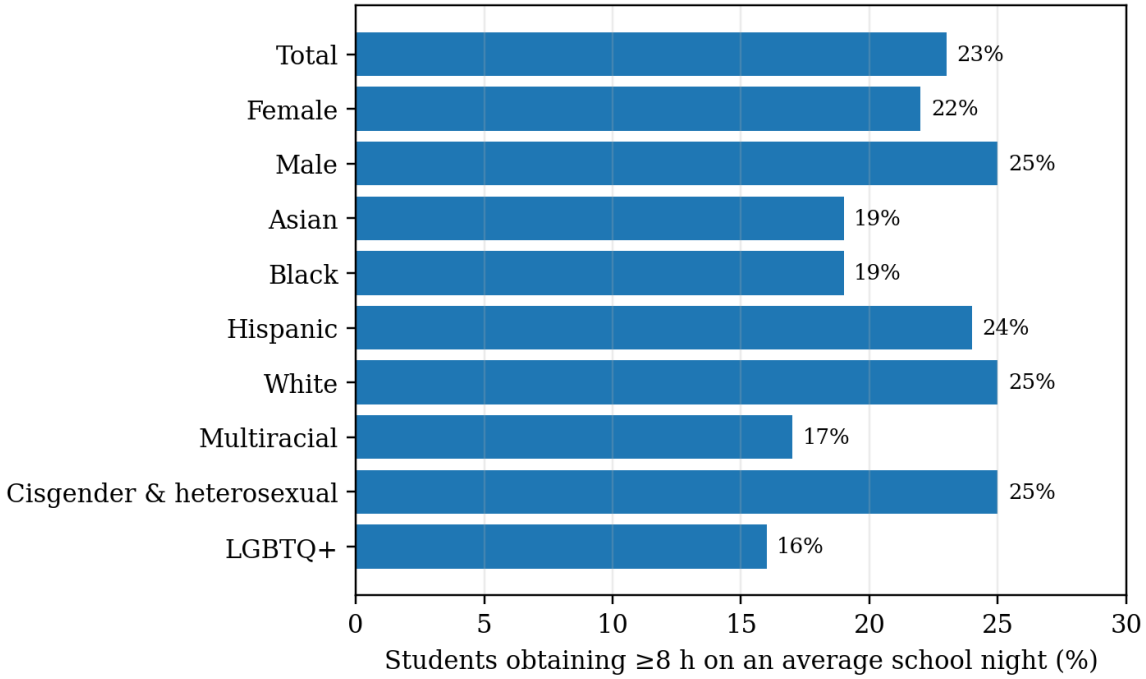


Figure 2. Percentage of High-School Students Obtaining at Least Eight Hours of Sleep, 2023
Source: Author visualization of CDC YRBS 2023 weighted prevalence estimates.

Time displacement is one proposed pathway through which nighttime screen engagement could reduce sleep opportunity. Device use extending into an intended sleep period necessarily competes with time in bed, and prior research links pre-bedtime engagement to later sleep timing (Pillion et al., 2022; Pagano et al., 2023). Bourke et al. (2026) reports a small within-person association with later sleep onset rather than uniform changes in all sleep outcomes. These studies inform a plausible mechanism, but the YRBS estimates analyzed here do not record the same students' exposure and sleep timing jointly. Asking about bedtime use and actual sleep schedules is a reasonable assessment priority, not an intervention effect demonstrated by this study.

Nocturnal device interruption is another hypothesis drawn from external studies. Notifications, late-night checking, and social interaction may fragment sleep, as reviewed by de Sá et al. (2023) and da Silva et al. (2022). Research on parental rules and device practices also describes potentially relevant family contexts (Van den Eijnden et al., 2021; Covolo et al., 2021). None of these variables was directly evaluated against sufficient-sleep prevalence in the aggregate YRBS comparisons. Families and schools may discuss device routines as one component of sleep assessment while also considering school schedules, stress, and household obligations.

Circadian and arousal pathways may operate alongside displacement. Evening light can influence circadian timing depending on spectral composition, intensity, duration, and individual sensitivity (Tähkämö et al., 2019), while interactive gaming, messaging, social conflict, and reward anticipation can maintain cognitive-emotional activation. Duan et al. (2024) illustrates how nighttime artificial light and insomnia-related digital activity can cluster in real-world settings, although ecological associations

require caution. Hartstein et al. (2024) similarly argues for sleep-health interpretation across multiple screen mechanisms. The surveillance data cannot separate these pathways, which is precisely why mechanistic literature is useful as interpretation rather than as a substitute for the official prevalence estimates.

The sleep deficit also has downstream implications beyond mental health. Persistent short or irregular sleep can compromise daytime attention, learning, emotional regulation, and health behavior, while shared determinants may connect poor sleep with sedentary behavior and adiposity (Gale et al., 2025). A student who sleeps six hours because of work or family demands differs from one who loses the same two hours to late-night gaming, but both may experience reduced restorative opportunity. Surveillance instruments should therefore pair digital-exposure questions with bedtime, wake time, sleep regularity, nighttime device access, and reasons for delayed sleep. Without those variables, screen time remains a broad marker and the population sleep deficit remains under-explained.

Table 4 juxtaposes separate YRBS sleep and mental-health indicators across decade endpoints. From 2013 to 2023, sufficient sleep fell by 7 points among girls and 10 points among boys, while persistent sadness or hopelessness rose by 14 and 7 points, respectively. Parallel changes do not show that the same respondents had both outcomes or that sleep decline mediated distress. Social conditions, school pressures, economic uncertainty, family stress, and variation in symptom reporting may contribute to these trends. The warranted inference is that two adolescent-health indicators merit coordinated monitoring, not that one accounts for the other.

Table 4. Decade Endpoint Changes in Sleep and Persistent Sadness/Hopelessness

Indicator	Group	2013	2023	Absolute change	Relative change
Sufficient sleep ≥8 h	Female	29%	22%	-7 pp	-24.1%
Sufficient sleep ≥8 h	Male	35%	25%	-10 pp	-28.6%
Persistent sadness / hopelessness	Female	39%	53%	+14 pp	+35.9%
Persistent sadness / hopelessness	Male	21%	28%	+7 pp	+33.3%

Sources: CDC YRBS 2013–2023 trend reports.

The second objective establishes persistent and unequal shortfalls in sufficient school-night sleep. Sleep deserves attention in adolescent health services independently of how much of its prevalence may be related to digital behavior. A proportionate response is to assess school-night schedules, sleep regularity, nighttime device use, and contextual barriers before choosing an intervention. Targeted sleep-support strategies should be evaluated prospectively rather than assumed effective from population trends. This avoids treating every screen hour as harmful or overlooking adolescents whose sleep is constrained primarily by other circumstances.

Screen-time gradients in psychological distress without linked sleep measures

NHIS–Teen provides screen-stratified anxiety and depression symptom estimates for adolescents ages 12–17. Anxiety symptoms were reported by 27.1% of those with at least four hours of weekday non-school screen time and by 12.3% of those below that threshold, an unadjusted 14.8-point difference and prevalence ratio of 2.20. Depression symptoms were 25.9% versus 9.5%, an unadjusted 16.4-point difference and ratio of 2.73. The NCHS report identified both contrasts as statistically significant. These cross-sectional differences do not establish temporal ordering, adjustment for confounders, or individual-level links to the separate YRBS sleep data. Elevated symptoms could precede extended screen use or reflect shared social, family, and psychological determinants.

Table 5 preserves the source-reported 95% confidence intervals for the screen-stratified symptom prevalences. Anxiety was 27.1% (23.7–30.8%) in the higher-screen group versus 12.3% (9.8–15.2%) in the lower-screen group; depression was 25.9% (22.2–29.8%) versus 9.5% (7.2–12.1%). The prevalence differences and ratios were calculated from these rounded weighted point estimates, with no covariate adjustment or newly estimated uncertainty intervals for those derived statistics. Their magnitudes therefore describe raw group contrasts, not independently attributable effects or clinical risk predictions. Comparing these results with YRBS trends is a narrative triangulation across different populations, not a joint statistical model.

Table 5. Anxiety and Depression Symptoms by Daily Screen Time, NHIS–Teen 2021–2023

Outcome	Screen time	Weighted prevalence (95% CI)	Difference vs <4 h	Prevalence ratio
Anxiety symptoms	<4 h/day	12.3% (9.8–15.2)	Reference	1.00
Anxiety symptoms	≥4 h/day	27.1% (23.7–30.8)	+14.8 pp	2.20
Depression symptoms	<4 h/day	9.5% (7.2–12.1)	Reference	1.00
Depression symptoms	≥4 h/day	25.9% (22.2–29.8)	+16.4 pp	2.73

Source: NCHS Data Brief No. 513, NHIS–Teen, July 2021–December 2023.

Figure 3 displays the two observed symptom gradients from NHIS–Teen. The fact that both gradients favor the lower-screen group does not establish a common mechanism, because exposure and symptoms were measured cross-sectionally and relevant confounders were not adjusted. Reviews by Santos et al. (2023) and Yang et al. (2022) describe heterogeneity in screen definitions, emotion regulation, and mental-health associations. Kokka et al. (2021) and Wang et al. (2021) further distinguish problematic use from duration alone. These findings suggest useful questions for future measurement but cannot explain the NHIS–Teen prevalence ratios within this secondary analysis.

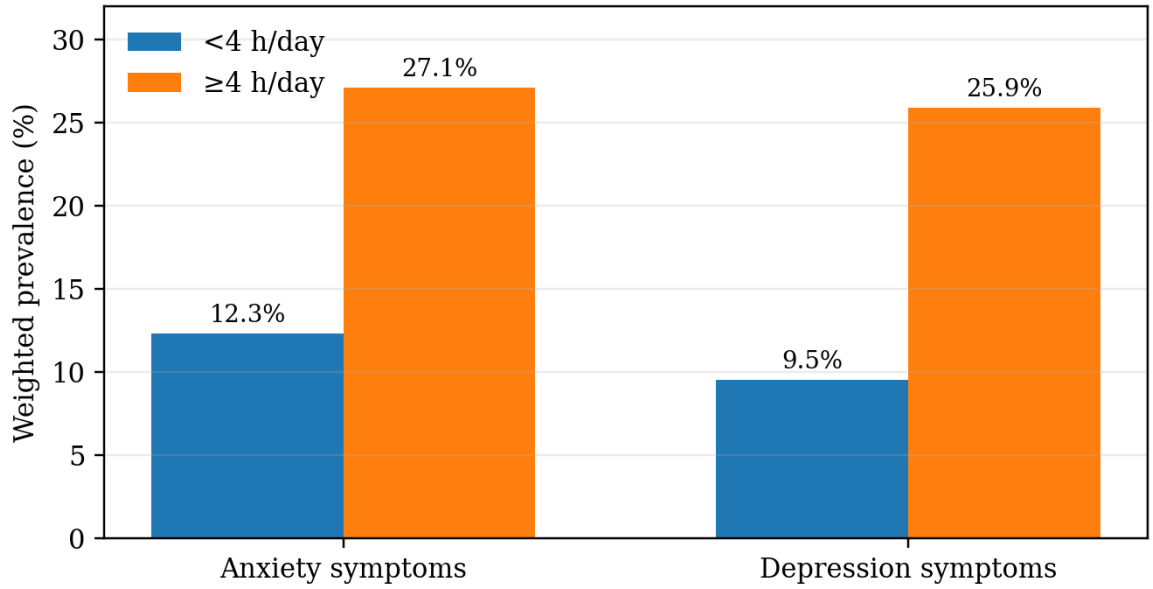


Figure 3. Anxiety and Depression Symptom Prevalence by Daily Screen-Time Category
Source: Author visualization of NCHS Data Brief No. 513 weighted estimates. The NCHS report states that differences between screen-time groups were statistically significant at $p < 0.05$.

YRBS 2023 separately documents pronounced demographic differences in mental-health indicators (Verlenden et al., 2024). Overall, 39.7% reported persistent sadness or hopelessness, 28.5% poor mental health, 20.4% serious consideration of suicide, and 9.5% a suicide attempt. Persistent sadness was reported by 52.6% of girls and 27.7% of boys, while poor mental health was 38.8% and 18.8%, respectively. NHIS–Teen estimated at least four screen hours for 52.5% of girls and 48.3% of boys, but these percentages concern a different sampling frame and cannot be directly correlated with YRBS mental-health prevalence. The separate patterns underscore the limitations of interpreting psychological distress through total screen duration alone.

YRBS also reported substantial mental-health disparities by sexual identity. Persistent sadness or hopelessness was 65.7% among LGBQ+ students and 31.4% among heterosexual students, an unadjusted 34.3-point gap and prevalence ratio of approximately 2.09. Poor mental health was 53.5% versus 21.5%, serious consideration of suicide 41.0% versus 13.0%, and suicide attempts 19.7% versus 6.0%. A separate YRBS sleep report documented lower sufficient-sleep prevalence among LGBTQ+

students, but the group definitions are not identical and these published summaries do not establish individual co-occurrence. Minority stress, discrimination, family acceptance, and social support are plausible contextual influences that require direct study. Screen time should not be used as a substitute explanation for these disparities.

Table 6 summarizes the scale of subgroup differences in YRBS psychological-distress and suicide-risk indicators. The results argue against relying on a universal screen-hour threshold as a stand-alone mental-health screening rule. A higher prevalence of distress in one demographic group does not show that particular group members have high screen exposure, and individual distress may occur at any screen duration. Future linked observations should test whether timing, sleep regularity, problematic use, and psychosocial stress improve risk identification beyond duration alone. The present aggregate tables identify monitoring priorities but cannot rank multivariable predictors of individual symptoms.

Table 6. Mental-Health and Suicide-Risk Indicators by Sex and Sexual Identity, YRBS 2023

Group	Sad/hopeless	Poor mental health	Considered suicide	Attempted suicide
Female	52.6%	38.8%	27.1%	12.6%
Male	27.7%	18.8%	14.1%	6.4%
Heterosexual	31.4%	21.5%	13.0%	6.0%
LGBQ+	65.7%	53.5%	41.0%	19.7%

Source: CDC, Mental Health and Suicide Risk Among High School Students and Protective Factors—YRBS, United States, 2023.

Sleep is a plausible link between digital habits and psychological distress in external prospective and theoretical research (Dibben et al., 2023; Bauducco et al., 2024). The present surveillance analysis, however, contains no matched individual records jointly measuring screen duration, sufficient sleep, and distress across the two survey systems. It consequently cannot demonstrate their three-way overlap, estimate mediation, or decide whether sleep precedes changes in mood. The possibility that distress also influences late-night technology use makes reverse causality important. Longitudinal follow-up with repeated sleep, activity-specific screen measures, and symptom assessments is necessary to evaluate these alternative pathways.

Different research designs can yield different effect sizes without being mutually inconsistent. Bourke et al. (2026) describes small within-person screen–sleep associations in several analyses, while broader reviews summarized by Fiore et al. (2025) and Brozatus et al. (2026) report heterogeneous between-person associations and methodological concerns. The NHIS–Teen prevalence ratios reported here are unadjusted cross-sectional contrasts, not effects of adding four hours of screen exposure. Family routines, baseline symptoms, school context, and self-regulation may influence both exposure and symptoms. As Sadoyu et al. (2022) emphasizes for evidence appraisal, inference must reflect the certainty and design of the underlying data.

The approach offers transparent national reference points, documented question wording, weighted estimates, and demographic stratification across surveillance systems. Its limitations are equally consequential: the YRBS school population differs from the NHIS–Teen household population; item definitions changed over time; all relevant exposure measures rely on self-report; and the low 2023 YRBS response rate permits residual nonresponse bias. Published aggregates prevent adjustment for confounders, individual-level linking, and direct estimation of joint screen–sleep–distress prevalence. Screen-duration questions also omit bedtime timing, content, perceived control, and nighttime interruptions. These restrictions delimit what the descriptive triangulation can support and identify variables for improved future data collection.

The third objective establishes a contemporary screen-time gradient in anxiety and depression symptoms, alongside separate evidence of substantial psychological distress in YRBS subgroups. These are distinct surveillance signals, not evidence that high exposure, insufficient sleep, and distress overlap in the same adolescents. Clinical and school assessments may use screen duration as a starting question, then evaluate symptoms, bedtime practices, sleep opportunity, social stress, and the purpose of online activity. Such screening priorities are reasonable implications of population need, not validated

predictions or intervention effects derived from these data. Future individual-level longitudinal studies should determine whether these additional measures identify actionable risks beyond screen hours alone.

CONCLUSION

The three objectives produced complementary but distinct population-level findings. First, published YRBS estimates suggest increased intensive non-school digital use from 2013 to 2019, although evolving item wording and the subsequent 2021 redesign prevent a single harmonized exposure trend. Contemporary NHIS–Teen figures instead describe the current burden of extended weekday screen time within a different adolescent population. Second, YRBS documents persistently low sufficient school-night sleep and demographic differences that warrant targeted surveillance of sleep opportunity. Third, NHIS–Teen shows higher unadjusted anxiety and depression symptom prevalence in its higher-screen group, while YRBS separately identifies large inequalities in psychological distress. None of these observations establishes that the three conditions coexist in the same individuals or that screen time causes sleep or mental-health outcomes.

The scientific contribution is a reproducible surveillance-triangulation framework that keeps historical measurement segments, survey populations, direct estimates, and descriptive calculations separate. For practice, schools and adolescent health services can monitor sleep and mood alongside screen duration while asking about timing, nighttime access, psychosocial stress, and functional impairment rather than using a single screen-hour cutoff as a diagnosis. National surveillance programs should preserve stable core questions, document instrument transitions, and evaluate response and reporting bias across subgroups. Linked longitudinal studies using repeated or device-derived exposure measures, validated sleep indicators, and mental-health assessments should test temporal ordering, confounding, and possible mediation. These steps would move beyond the limitations of unadjusted cross-sectional and aggregate comparisons without overstating the present findings.

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